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**(54) Tube cutter and slitter with locking mechanism**

Rohrschneider und -schlitzer mit Verriegelung

Découpeur transversal et longitudinal de tuyaux avec verrouillage

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## Description

### RELATED APPLICATION DATA

### BACKGROUND

**[0001]** The present invention relates to hand operated cutters. More specifically, the present invention relates to hand operated cutters for cutting and splitting tubes.

**[0002]** The use of tubes, including PEX (cross-linked polyethylene) tubes has become popular in plumbing. The tubes are lower cost than copper and are suitable for use in the construction of new buildings and homes. US 6370780 shows a spring-biased cutting tool suitable for cutting plastic pipes with two elongated members pivotally connected to each other in a scissors-like manner, each elongated member having a handle portion and a jaw portion with one jaw portion including a knife blade and the other an anvil.

### SUMMARY

**[0003]** The present invention provides a tube cutting tool as defined in claim 1.

**[0004]** Other features and aspects of the invention will become apparent by consideration of the following detailed description and accompanying drawings and dependent claims.

### BRIEF DESCRIPTION OF THE DRAWINGS

#### **[0005]**

- Fig. 1 is a perspective view of a cutter according to one embodiment of the invention;
- Fig. 2 is an enlarged perspective view of a portion of the cutter of Fig. 1;
- Fig. 3 is an enlarged perspective view of another portion of the cutter of Fig. 1;
- Fig. 4 is partially broken away perspective view of a portion of the cutter of Fig. 1;
- Fig. 5 is a section view of a portion of the cutter taken along line 5-5 of Fig. 1;
- Fig. 6 is a section view of a portion of the cutter taken along line 6-6 of Fig. 1; and
- Fig. 7 is an exploded perspective view of the cutter of Fig. 1.

### DETAILED DESCRIPTION

**[0006]** Before any embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the following drawings. The invention is capable of other embodiments and of being practiced or of being carried out in various ways.

**[0007]** Fig. 1 illustrates a cutter 10 that is well-suited

to the task of cutting tubes. In particular the cutter 10 is well-suited to cutting plastic tubes such as PEX (cross-linked polyethylene) tubes. The cutter 10 includes a first handle 15 (sometimes referred to as an outside handle) and a second handle 20 (sometimes referred to as an inside handle).

**[0008]** The first handle 15 includes a first grip portion 25 disposed at one end of the first handle 15 and a first head portion 30 disposed at the opposite end of the first handle 15. The first grip portion 25 is preferably curved to better fit into a user's hand. However, straight portions or different ergonomically-shaped first grip portions 25 could also be employed. In the illustrated construction, a soft grip 35 is positioned over a portion of the first grip portion 25 to improve the grip between the user and the cutter 10. In some constructions, the soft grip 35 is formed as a separate piece and is then positioned on the first grip portion 25. In preferred constructions, the soft grip 35 is over molded or co-molded into position. Of course, other constructions form the soft grip 35 and position the soft grip 35 using other processes and methods.

**[0009]** The first head portion 30 includes two spaced apart side portions 40 that cooperate to define a space 45 between the side portions 40. The side portions 40 each include an arcuate aperture 50 that in some constructions is semi-circular. A smaller pivot aperture 55 extends through the first head portion 30 and defines a first pivot axis 60. A first end of the first head portion 30 includes a concave surface 65 that defines a slot 70 or opening (shown in Fig. 2). The slot 70 extends in a slitting direction 75 and the concave surface 65 is preferably arranged such that the slitting direction 75 is parallel to an axis defined by the focus or center of the concave surface 65. Preferably, the slitting direction 75 is also normal to the first pivot axis 60.

**[0010]** In preferred constructions, the first head portion 30 and the first grip portion 25 are formed as a single piece to improve the strength of the first handle 15. Of course, other constructions could form the first head portion 30 separate from the first grip portion 25 and attach them using a suitable attachment means (e.g., welding, soldering, brazing, co-molding, fasteners, adhesives, etc.).

**[0011]** The second handle 20 includes a second grip portion 80 and a second head portion 85. The second grip portion 80 is similar to the first grip portion 25 of the first handle 15 and will not be described in detail. In addition, the second grip portion 80 and the second head portion 85 can be formed as one piece or multiple pieces in much the same way as has been described with regard to the first handle 15 and will not be described in detail.

**[0012]** The second head portion 85 includes a second arcuate aperture 90 that in preferred constructions is semicircular. A slot 95 is formed in a portion of a wall 100 that defines the second arcuate aperture 90 and is sized to receive a portion of a cutting blade 105. In the illustrated construction, the cutting blade 105 fits within the slot 95 and is attached to the second head portion 85 using two

fasteners 110. Thus, the cutting blade 105 is easily removable and replaceable. The second head portion 85 also includes a pivot aperture 115 (shown in Fig. 7) that extends along the pivot axis 60.

**[0013]** The second head portion 85 is sized to fit within the space 45 between the first side portion 40 and the second side portion 40 of the first head 30. The first pivot aperture 55 aligns with the second pivot aperture 115. A pin or fastener 120 passes through the pivot apertures 55, 115 to pivotally connect the first handle 15 and the second handle 20. Once connected, the first grip portion 25 and the second grip portion 80 cooperate to define a comfortable and convenient grip for a user.

**[0014]** The cutter 10 of Fig. 1 is movable between a closed or slitting position (shown in Figs. 1 and 2) and an open position. In preferred constructions, a biasing member 121 (shown in Fig. 7) is positioned to bias the first handle 15 and the second handle 20 toward the open position. Suitable biasing members 121 could include springs (e.g., coil, leaf, torsional, etc.) or other biasing members that function to move the handles 15, 20 toward the open position.

**[0015]** In the open position, the first grip portion 25 and the second grip portion 80 are separated, thereby separating the first head portion 30 and the second head portion 85. In this position, the arcuate apertures 50, 90 are spaced apart from one another a distance sufficient for the positioning of a tube within the arcuate apertures 50, 90. The tube can rest against the aperture walls formed in the first side portion 40 and the second side portion 40. As the cutter 10 (or handles 15, 20) moves toward the closed position, a bottom cutting edge 125 of the blade 105 contacts the tube and begins cutting the tube. In the closed position, the blade 105 has moved through the tube and the cutting edge 125 of the blade 105 is disposed beneath the arcuate apertures 50 of the first head portion 30 and in the space 45 between the first side portion 40 and the second side portion 40. In the illustrated construction, the cutting edge 125 includes a first corner, a second corner, and a point in the middle and is therefore substantially V-shaped. However, other constructions could use straight cutting edges that are normal to the tube or angled with respect to the tube, curved blades, or other suitable shapes.

**[0016]** If the user further squeezes the first grip portion 25 and the second grip portion 80, the cutter 10 will move toward the closed or slitting position as illustrated in Fig. 2. In the slitting position, a slitting portion 130 of the cutting edge 125 of the blade 105 extends through the slot 70 defined in the concave surface 65 of the first head portion 30. In this position, the cutter 10 can be positioned against a tube to slit the tube in a lengthwise direction. The concave surface 65 engages the outer surface of the tube being slit to improve the contact between the tube and the cutter 10. In the illustrated construction, the slitting portion 130 is at least partially defined by the first corner of the cutting edge 125.

**[0017]** Figs. 3-4 illustrate a locking mechanism 135 that

is suited to locking the first handle 15 and the second handle 20 in the slitting position. As illustrated in Fig. 3, the first head portion 30 includes an external channel 140 that receives a slider 145. The channel is substantially rectangular and extends in a substantially linear direction. The slider 145 is movable between a locked position in which the first handle 15 and the second handle 20 are inhibited from moving with respect to one another and an unlocked position in which the first handle 15 and the second handle 20 are substantially free to pivot about the pivot axis 60.

**[0018]** As illustrated in Figs. 4 and 5, the slider 145 includes a pin 150 that extends through the external channel 140 and into the second head portion 85. The pin 150 has a groove 151 that runs around an outer perimeter of the pin 150. A spring plate 152 is disposed, and preferably fixedly attached to the pin 150, and is secured to the pin 150 by an e-clip 153. The spring plate 152 includes two legs that extend from the pin 150 (when the spring plate 152 is attached to the pin 150) in a cantilever fashion and define two protrusions 154. In the illustrated construction, the pin 150 is cuboidal, with other shapes being possible.

**[0019]** As best seen in Fig. 5, when the slider 145 is in the locked position (i.e., when the slider is pushed toward the blade 105 in the illustrated construction) the protrusions 154 contact a wall 155, the wall 155 defining a side of the external channel 140. The interference between the wall 155 and the protrusions 154 serves to inhibit the slider 145 from leaving the locked position while still allowing the pin 150 and protrusions 154 to move within the channel 140. The user may move the slider 145 out of the locked position by applying a force to the slider 145 (in a direction away from the blade 105), thus forcing the protrusions 154 to move along the wall 155 and onto an internal surface 160 of the first head portion 30. After moving along the internal surface 160, the protrusions 154 will engage an indentation 165 formed in the first head portion 30 that cooperates with the protrusions 154 to bias the slider 145 into the unlocked position and inhibit movement out of that position. Thus, the spring plate 152, and more specifically the protrusions 154 cooperates with the first head portion 30 to bias the pin 150 into one of the locked position and the unlocked position.

**[0020]** The slider 145 serves to place the cutter 10 in the locked position or the unlocked position. In the unlocked position the first handle 15 and second handle 20 are biased away from each other by the biasing member 121, however, the biasing member 121 is sized and configured so that the user may overcome the biasing force so that the cutter 10 may be operated in a scissors motion.

**[0021]** As best seen in Fig. 6, the second head portion 85 includes a first channel 205 and a second channel 157 that cooperate with one another to define a V-shaped channel 210. In the illustrated construction, the first channel 205 is substantially rectangular or linear and defines a substantially linearly extending leg and the second channel 157 is arcuate and defines a substantially arcu-

ate leg. The second channel 157 is arranged such that it curves around a center 215 that resides on or near the pivot axis 60 of the first handle 15 and the second handle 20. When the handles 15, 20 are in the closed position, the first channel 205 substantially overlies the channel 140 formed in the first head portion 30. Thus, the slider 145 and the pin 150 are free to move along the entire length of the first channel 205. When the pin 150 is moved toward the cutting blade 105 as illustrated in Fig. 6, it moves out of the space defined by the second channel 157 such that the walls that define the first channel 205 inhibit movement of the pin 150 around the pivot axis 60. If the pin 150 cannot move around the pivot axis 60, the handles 15, 20 cannot pivot about each other and the device is fixed in the locked position. When the user moves the slider 145 away from the cutting blade 105 and into the second channel 157, the pin 150 becomes free to move about the pivot axis 60, thereby freeing the handles 15, 20 for movement to the open position.

**[0022]** In the locked position, the first handle 15 and second handle 20 are held proximate to each other, as seen in Fig. 1, and the slider 145 inhibits the first handle 15 and second handle 20 from moving relative to one another. In the locked position, the cutter is in the slitting position so that the slitting portion 130 is disposed as seen in Fig. 1 so that a user may slice a tube as has been described.

**[0023]** Although the invention has been described in detail with reference to certain preferred embodiments, variations and modifications exist within the scope of the claims.

**[0024]** Thus, the invention provides, among other things, a tube cutter. Various features and advantages of the invention are set forth in the following claims.

## Claims

1. A cutting tool (10) adapted to cutting a tube, the cutting tool (10) comprising:

a first grip portion (25);  
 a second grip portion (80);  
 a second head portion (85) coupled to the second grip portion (80) to define a second handle (20), the second head portion (85) including a cutting blade (105) having a cutting portion (125) and a slitting portion (130);  
 a first head portion (30) coupled to the first grip portion (25) to define a first handle (15), the first head portion (30) including an arcuate portion (50) sized and configured to support the tube and a concave portion (65) sized to receive a portion of the tube, the second handle (20) pivotally coupled to the first handle (15) to move between an open position and a closed position, wherein the cutting portion (125) is operable to cut the tube as the handles (20, 15) move from

the open position and the closed position, and wherein the slitting portion (130) is operable to slice the tube supported in the concave portion (65) when the handles (20, 15) are in the closed position.

2. The cutting tool (10) of claim 1, wherein the second grip portion (80) and the second head portion (85) are formed simultaneously as a single piece.
3. The cutting tool (10) of claim 1 or 2, further comprising a soft grip member coupled to the second grip portion (80).
4. The cutting tool (10) of any preceding claim, wherein the blade (105) includes an edge that defines a first corner and a second corner, and wherein the edge defines the cutting portion (125) and the first corner defines the slitting portion (130); and wherein optionally the edge may be V-shaped and define a point disposed between the first corner and the second corner.
5. The cutting tool (10) of any preceding claim, wherein the first head portion (30) includes a slot (70) that extends from the arcuate portion (50) to the concave portion (65) such that when the handles (20, 15) are in the closed position, the slitting portion (130) extends through the slot (70) and into the concave portion (65).
6. The cutting tool (10) of any preceding claim, further comprising a biasing member (121) operable to bias the second handle (20) and the first handle (15) toward the open position.
7. The cutting tool (10) of any preceding claim, further comprising a locking mechanism (135) movable between a locked position wherein movement of the second handle (20) with respect to the first handle (15) is inhibited and an unlocked position wherein the second handle (20) is freely movable with respect to the first handle (15).

## Patentansprüche

1. Schneidwerkzeug (10), welches zum Schneiden eines Rohrs ausgebildet ist, wobei das Schneidwerkzeug (10) umfasst:

einen ersten Griffabschnitt (25);  
 einen zweiten Griffabschnitt (80);  
 einen zweiten Kopfabschnitt (85), welcher mit dem zweiten Griffabschnitt (80) verbunden ist, um einen zweiten Griff (20) zu definieren, wobei der zweite Kopfabschnitt (85) eine Schneidklingen-

- ge (105) umfasst, welche einen Schneidabschnitt (125) und einen Schlitzabschnitt (130) aufweist;  
einen ersten Kopfabschnitt (30), welcher mit dem ersten Griffabschnitt (25) verbunden ist, um einen ersten Griff (15) zu definieren, wobei der erste Kopfabschnitt (30) einen bogenförmigen Abschnitt (50), welcher dimensioniert und konfiguriert ist, um das Rohr zu stützen, und einen konkaven Abschnitt (65) umfasst, welcher dimensioniert ist um einen Abschnitt des Rohrs aufzunehmen, wobei der zweite Griff (20) mit dem ersten Griff (15) schwenkbar verbunden ist, um sich zwischen einer offenen und einer geschlossenen Stellung zu bewegen, wobei der Schneidabschnitt (125) betätigbar ist, um das Rohr zu schneiden, wenn die Griffe (20, 15) sich von der offenen in die geschlossene Stellung bewegen, und wobei der Schlitzabschnitt (130) betätigbar ist, um das im konkaven Abschnitt (65) gestützte Rohr zu kappen, wenn die Griffe (20, 15) sich in der geschlossenen Stellung befinden.
2. Schneidwerkzeug (10) nach Anspruch 1, wobei der zweite Griffabschnitt (80) und der zweite Kopfabschnitt (85) einstückig gleichzeitig geformt werden.
  3. Schneidwerkzeug (10) nach Anspruch 1 oder 2, ferner umfassend ein weiches Griffglied, welches mit dem zweiten Griffabschnitt (80) verbunden ist.
  4. Schneidwerkzeug (10) nach einem der vorhergehenden Ansprüche, wobei die Klinge (105) eine Kante umfasst, welche eine erste Ecke und eine zweite Ecke definiert, und wobei die Kante den Schneidabschnitt (125) definiert und wobei die erste Ecke den Schlitzabschnitt (130) definiert; und wobei, optional, die Kante eine V-förmige Gestalt aufweisen und einen Punkt definieren kann, welcher zwischen der ersten Ecke und der zweiten Ecke liegt.
  5. Schneidwerkzeug (10) nach einem der vorhergehenden Ansprüche, wobei der erste Kopfabschnitt (30) eine Nut (70) umfasst, welche sich vom bogenförmigen Abschnitt (50) zum konkaven Abschnitt (65) erstreckt, so dass wenn die Griffe (20, 15) sich in der geschlossenen Stellung befinden, der Schlitzabschnitt (130) sich durch die Nut (70) und in den konkaven Abschnitt (65) erstreckt.
  6. Schneidwerkzeug (10) nach einem der vorhergehenden Ansprüche, ferner umfassend ein Vorspann- glied (121), welches betätigbar ist, um den zweiten Griff (20) und den ersten Griff (15) zur offenen Stellung vorzuspannen.

7. Schneidwerkzeug (10) nach einem der vorhergehenden Ansprüche, ferner umfassend eine Verriegelung (135), welche zwischen einer verriegelten Position, in der die Bewegung des zweiten Griffs (20) relativ zum ersten Griff (15) unterbunden ist und einer entriegelten Position bewegbar ist, in welcher der zweite Griff (20) sich relativ zum ersten Griff (15) frei bewegen kann.

## Revendications

1. Outil de coupe (10) adapté pour couper un tube, l'outil de coupe (10) comprenant :  
  
une première partie de préhension (25) ;  
une deuxième partie de préhension (80) ;  
une deuxième partie de tête (85) accouplée à la deuxième partie de préhension (80) pour définir une deuxième poignée (20), la deuxième partie de tête (85) incluant une lame de coupe (105) comportant une partie de coupe (125) et une partie de refendage (130) ;  
une première partie de tête (30) accouplée à la première partie de préhension (25) pour définir une première poignée (15), la première partie de tête (30) incluant une partie arquée (50) dimensionnée et configurée pour supporter le tube, et une partie concave (65) dimensionnée pour recevoir une partie du tube, la deuxième poignée (20) étant accouplée de manière pivotante à la première poignée (15) en vue d'un déplacement entre une position ouverte et une position fermée, la partie de coupe (125) servant à couper le tube lorsque les poignées (20, 15) se déplacent de la position ouverte et de la position fermée, la partie de refendage (130) servant à fendre le tube supporté dans la partie concave (65) lorsque les poignées (20, 15) se trouvent dans la position fermée.
2. Outil de coupe (10) selon la revendication 1, dans lequel la deuxième partie de préhension (80) et la deuxième partie de tête (85) sont formées de manière simultanée sous forme d'une seule pièce.
3. Outil de coupe (10) selon les revendications 1 ou 2, comprenant en outre un élément de préhension souple accouplé à la deuxième partie de préhension (80).
4. Outil de coupe (10) selon l'une quelconque des revendications précédentes, dans lequel la lame (105) inclut une arête définissant un premier coin et un deuxième coin, et dans lequel l'arête définit la partie de coupe (125), le premier coin définissant la partie de refendage (130), et dans lequel, optionnellement :

l'arête peut avoir une forme en V et définir une pointe disposée entre le premier coin et le deuxième coin.

5. Outil de coupe (10) selon l'une quelconque des revendications précédentes, dans lequel la première partie de tête (30) inclut une fente (70) s'étendant de la partie arquée (50) vers la partie concave (65), de sorte que lorsque les poignées (20, 25) se trouvent dans la position fermée, la partie de refendage (130) s'étend à travers la fente (70) et dans la partie concave (65). 5  
10
6. Outil de coupe (10) selon l'une quelconque des revendications précédentes, comprenant en outre un élément poussoir (121) servant à pousser la deuxième poignée (20) et la première poignée (15) vers la position ouverte. 15
7. Outil de coupe (10) selon l'une quelconque des revendications précédentes, comprenant en outre un mécanisme de verrouillage (135) pouvant se déplacer entre une position verrouillée, dans laquelle le déplacement de la deuxième poignée (20) par rapport à la première poignée (15) est inhibé, et une position déverrouillée, dans laquelle la deuxième poignée (20) peut être déplacée librement par rapport à la première poignée (15). 20  
25

30

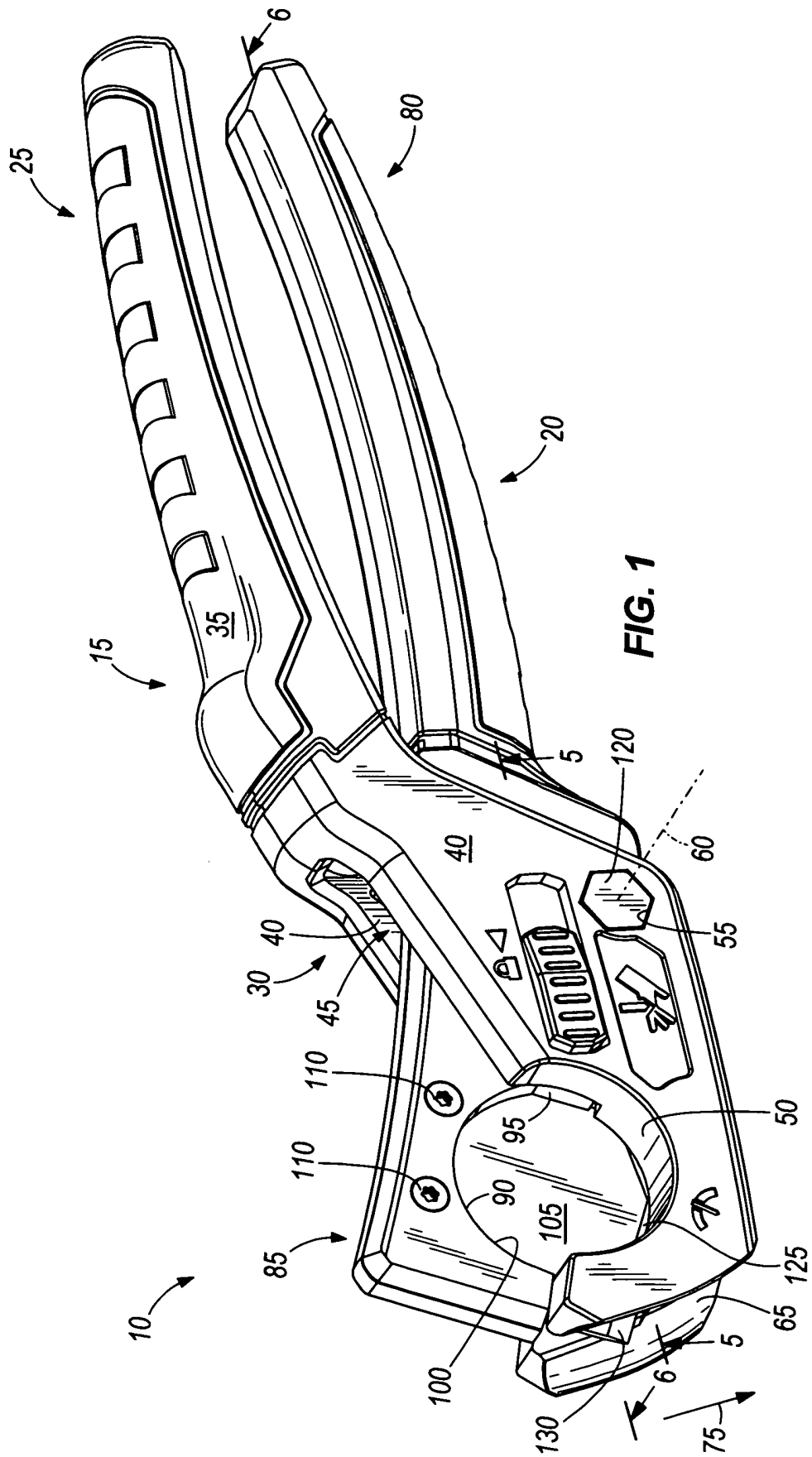
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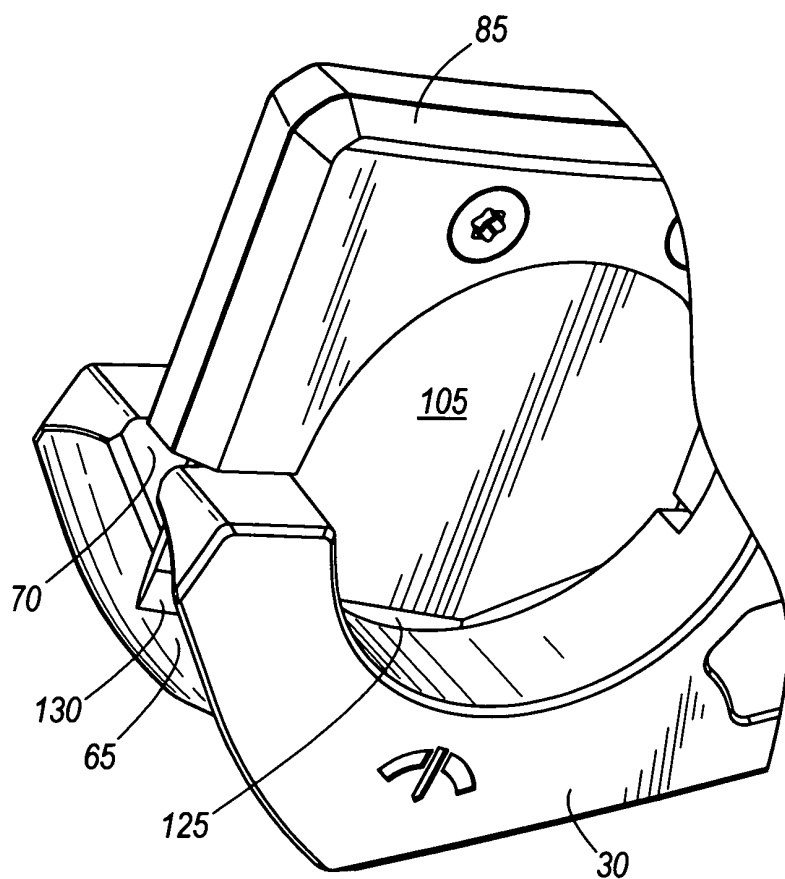
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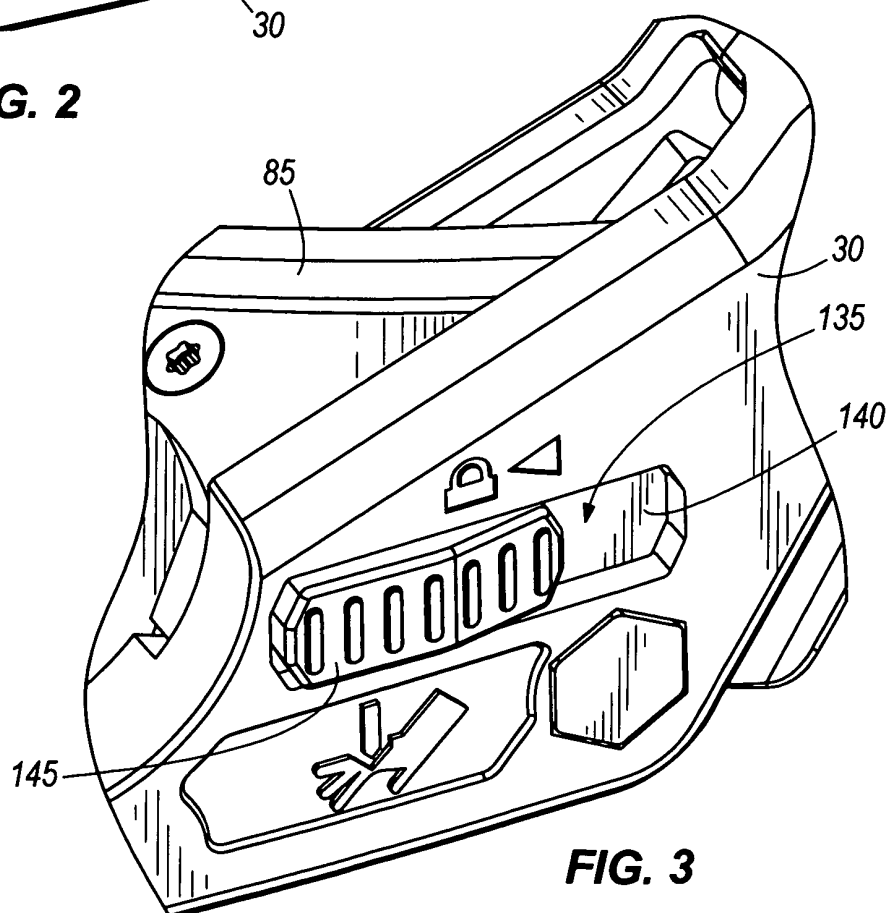
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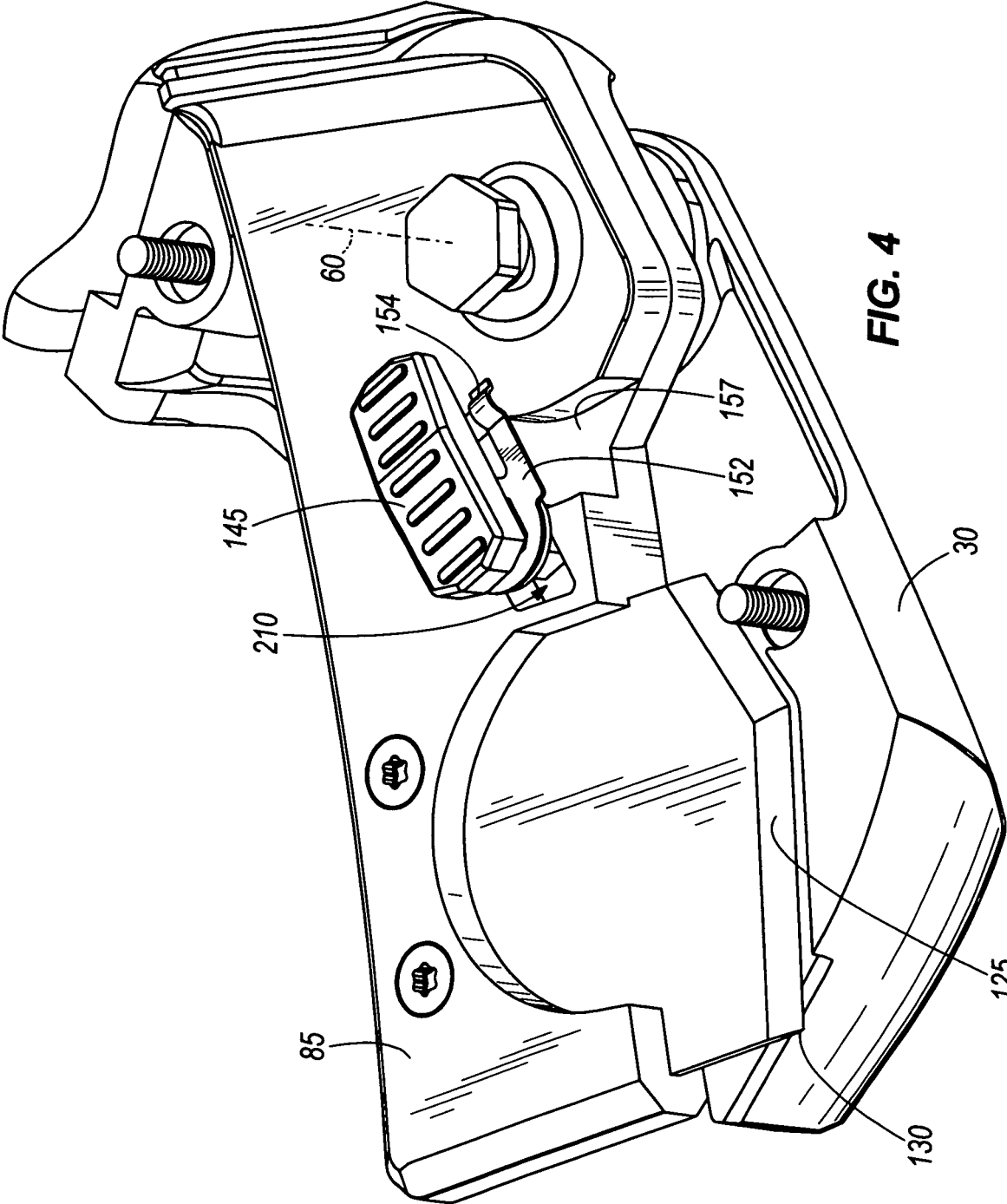


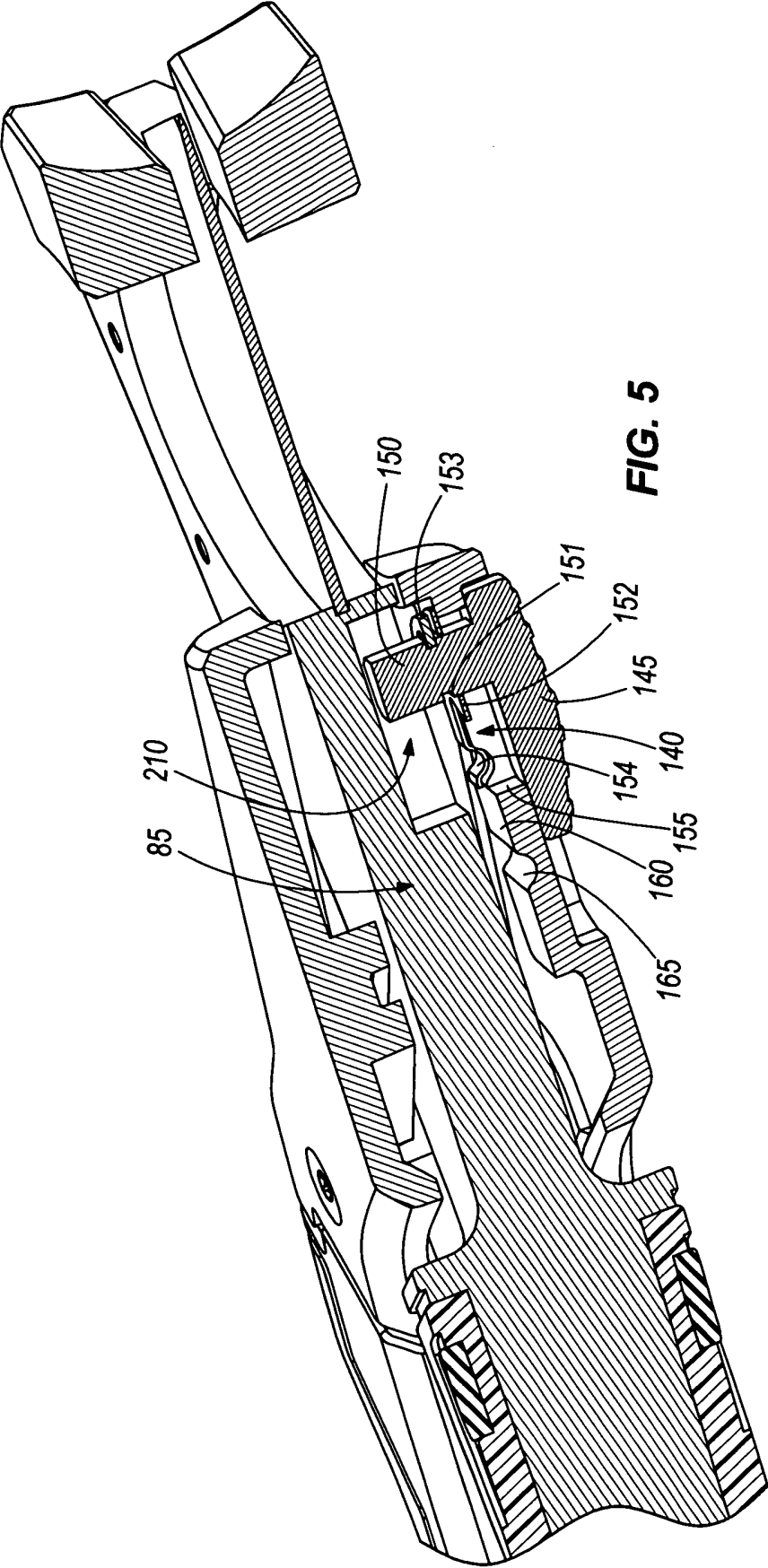


**FIG. 2**



**FIG. 3**





**FIG. 5**

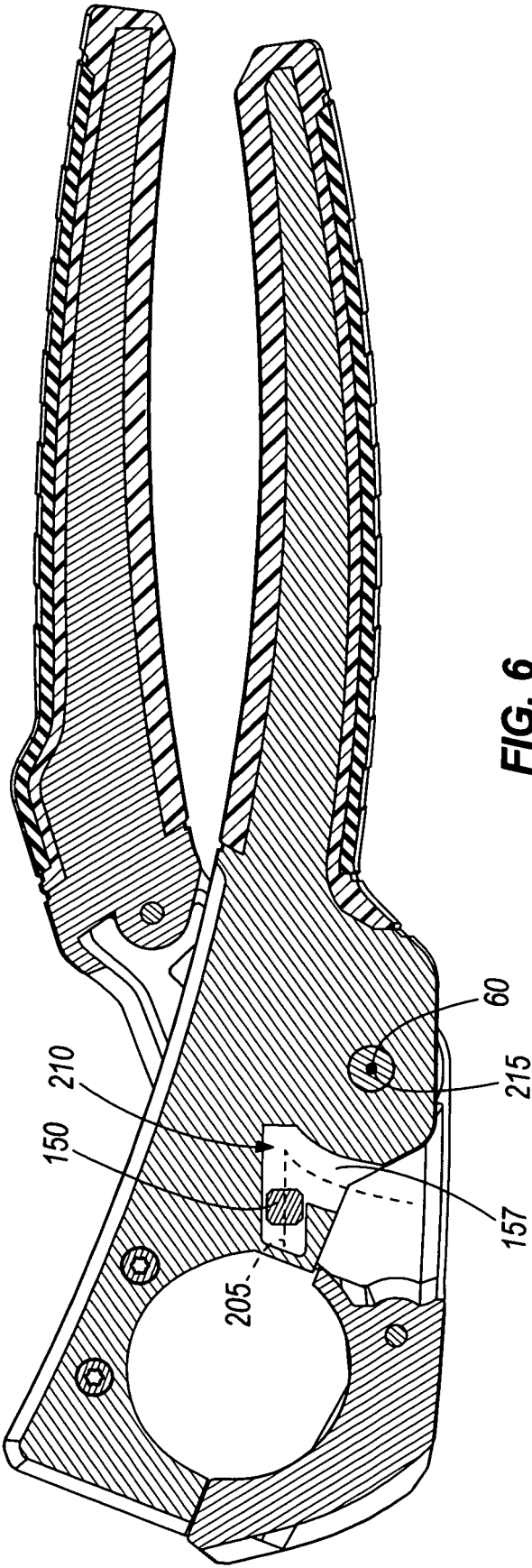


FIG. 6

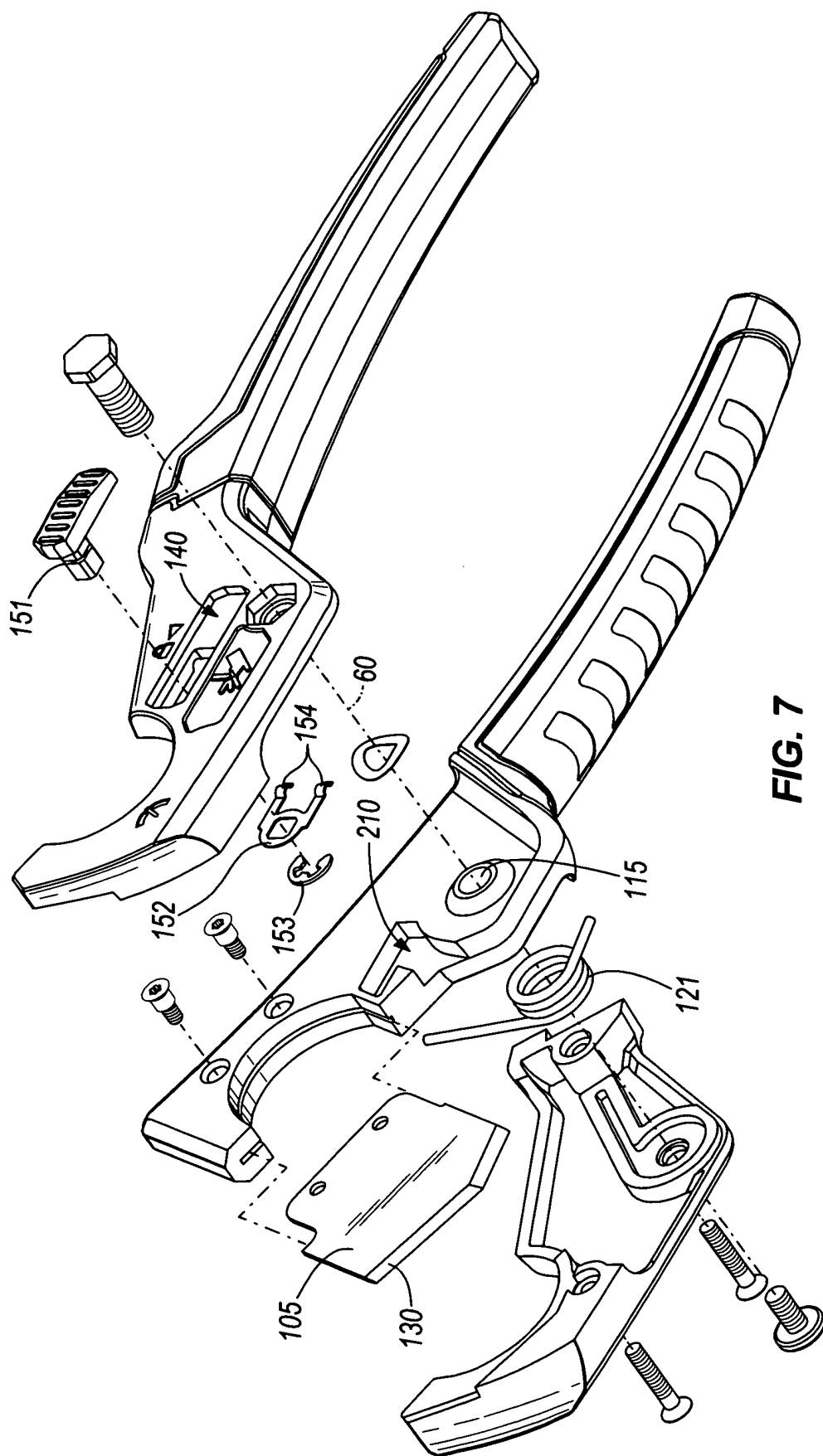


FIG. 7

**REFERENCES CITED IN THE DESCRIPTION**

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